

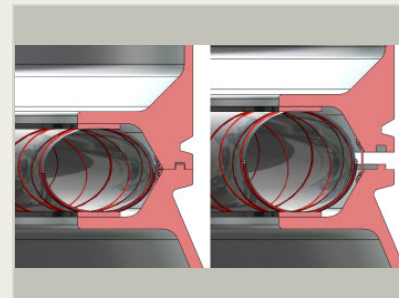
Thermally Insulative Structural Connection for Cryogenic Propellant Tanks, Phase I

Completed Technology Project (2016 - 2016)



Project Introduction

Paragon Space Development Corporation and Thin Red Line Aerospace (TRLA) propose a unique solution that thermally isolates the upper stage rocket from a payload on orbit while still providing adequate structural connection for orbital maneuvers. Cryogenic fluids such as LH2 and LOX are ideal upper stage propellants because of their high specific impulse. Unfortunately, the high thermal conductivity of the adapter and payload interface or between the O2 and H2 tanks themselves allows significant heat transfer between the sections, ultimately opening a relief valve that vents the propellant to space. Once vented, the propellant is lost forever resulting in a limited on-orbit useful life for cryogenic upper stages. The proposed solution provides an insulative structural connection between the payload and the upper stage utilizing an inflatable annulus with performance attributes from TRLA's Ultra High Performance Vessel (UHPV) technology that provides an inflatable structure with fully determinate load paths and the highest specific strength and stiffness of any soft-goods architecture. By using the existing payload adapter technology and separation systems for the ascent, the long heritage and reliability of these systems are maintained. Once on orbit, the primary structural connection between payload and adapter separate as normal while the inflatable structure is deployed. The pressurized fabric ring acts as a thermal insulator significantly reducing the undesired heat leak while still providing structural characteristics at 0.2 g's of sustained compressive loads for station keeping, attitude control and telemetry. The innovation will ultimately allow cryogenic propellants stored in an on-orbit depot to have a longer storage life while still utilizing the services of an attached upper stage. Additionally, it will allow an upper stage with a conventional payload to loiter for longer periods in LEO before too much propellant boils off.



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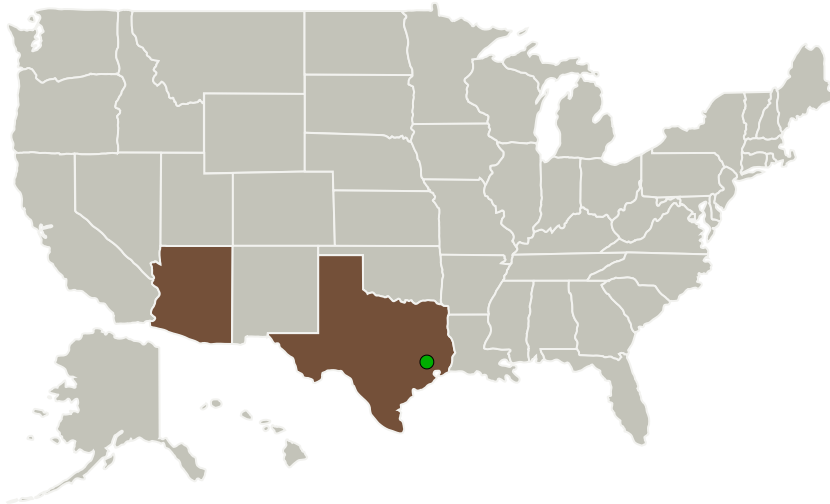
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Paragon Space Development Corporation	Lead Organization	Industry	Tucson, Arizona
● Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Arizona	Texas

Project Transitions

June 2016: Project Start

December 2016: Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138538>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Paragon Space Development Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

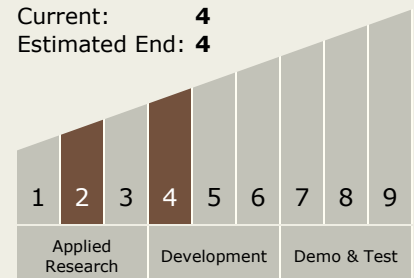
Chad E Bower

Technology Maturity (TRL)

Start: **2**

Current: **4**

Estimated End: **4**

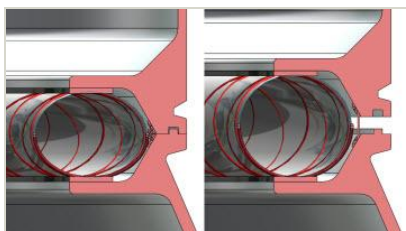


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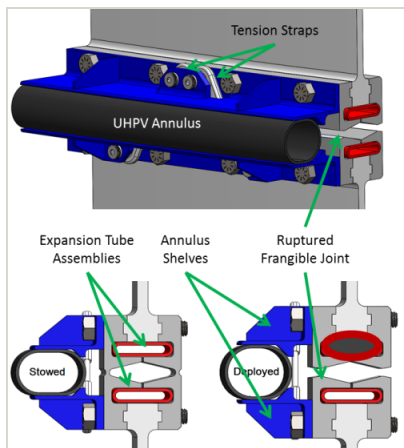
Images



Briefing Chart Image

Thermally Insulative Structural Connection for Cryogenic Propellant Tanks, Phase I

(<https://techport.nasa.gov/image/133859>)



Final Summary Chart Image

Thermally Insulative Structural Connection for Cryogenic Propellant Tanks, Phase I Project Image

(<https://techport.nasa.gov/image/131610>)

Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.2 Electric Space Propulsion
 - └ TX01.2.1 Integrated Systems and Ancillary Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System